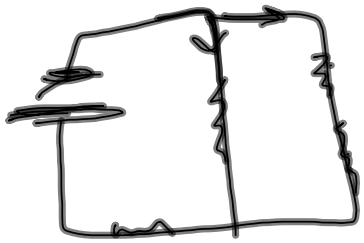
Series
I = same
V = Diff

Parallel
I = Diff
V = same



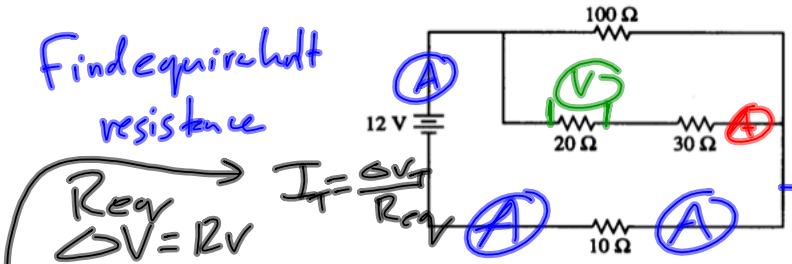
1996B4. A student is provided with a 12.0-V battery of negligible internal resistance and four resistors with the following resistances: 100 Ω, 30 Ω, 20 Ω, and 10 Ω. The student also has plenty of wire of negligible resistance available to make connections as desired.

a. Using all of these components, draw a circuit diagram in which each resistor has nonzero current flowing through it, but in which the current from the battery is as small as possible.

small current = large resistance => series

b. Using all of these components, draw a circuit diagram in which each resistor has nonzero current flowing through it, but in which the current from the battery is as large as possible (without short circuiting the battery).

Large current = small resistance => parallel



Find equivalent resistance

R_{eq}

$\Delta V = IR$

$I = \frac{\Delta V}{R_{eq}}$

The battery and resistors are now connected in the circuit shown above.

c. Determine the following for this circuit.

i. The current in the 10-Ω resistor 0.27

ii. The total power consumption of the circuit (P = IV)

d. Assuming that the current remains constant, how long will it take to provide a total of 10,000 J of electrical energy to the circuit?

3.32

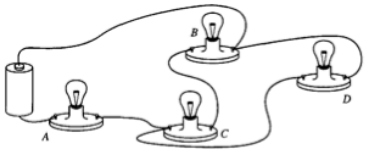
$P = \frac{\Delta E}{\Delta t}$ $[J/s] = [W]$

e. In the circuit, draw in how you would connect the following:

An ammeter to measure the current in the 10 ohm resistor.

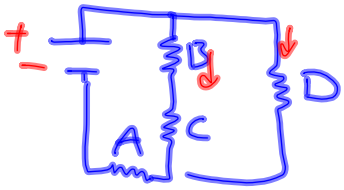
A voltmeter to measure the change in voltage across the 20 ohm resistor.

An ammeter to measure the current in the 30 ohm resistor.



1998B4 In the circuit shown above, A, B, C, and D are identical lightbulbs. Assume that the battery maintains a constant potential difference between its terminals (i.e., the internal resistance of the battery is assumed to be negligible) and the resistance of each lightbulb remains constant.

a. Draw a diagram of the circuit in the space below, using resistor symbols to represent the bulbs in your diagram. Label the resistors A, B. C, and D to refer to the corresponding lightbulbs.



b. List the bulbs in order of their brightnesses (Brightness depends on current), from brightest to least bright. If any two or more bulbs have the same brightness, state which ones. Justify your answer.

A = brightest

B = C b/c series

D > B = C

less resistance

A > D > B = C

c. Bulb D is then removed from its socket.

i. Describe the change in the current, if any, of bulb A when bulb D is removed from its socket (making the circuit open). Justify your answer. (Think about total resistance of the circuit and total current)

$R_{eq} \uparrow \Rightarrow I_A \downarrow$

ii. Describe the change in voltage in bulb A when D is removed. Justify your answer.

$\downarrow \leftarrow I_A = \frac{\Delta V_A \rightarrow \downarrow}{R_A \rightarrow \text{same}}$

iii. Describe the change in voltage in bulbs B and C when D is removed.

$V_a \downarrow$ $\Delta V_{Total} = \text{same}$

B & C must increase

iv. Describe the change in the brightness, if any, of bulb B when bulb D is removed from its socket. Justify your answer.

$V_B \uparrow \leftarrow I_B = \frac{V_B \rightarrow \uparrow}{R_B \leftarrow \text{same}}$

increase